CLAIMS

What is claimed is:

1. A vehicle having an integrated propulsion and guidance system, the vehicle comprising:

    an engine configured to rotate a driveshaft;

    an impeller coupled to the driveshaft to thereby propel the vehicle, wherein the impeller comprises a hub, a plurality of fixed blades, and at least one control blade coupled to a magnet and configured to rotate with respect to the hub;

    a control system coupled to the impeller, wherein the control system is configured to provide a control signal; and

    a magnetic actuator configured to receive the control signal and to produce an electromagnetic field as a function of the control signal, wherein the magnetic field is operable to displace the magnet and to thereby pivot the at least one control blade with respect to the hub.

2. The vehicle of claim 1 wherein the magnetic actuator comprises an electromagnet having an electrical conductor.

3. The vehicle of claim 2 wherein the control signal corresponds to an electrical current provided to the electrical conductor.

4. The vehicle of claim 1 wherein the control signal comprises a sinusoidal waveform.

5. The vehicle of claim 1 wherein the control signal comprises a sawtooth waveform.

6. The vehicle of claim 1 wherein the magnet is a permanent magnet.

7. The vehicle of claim 1 wherein the control system is further configured to adjust the phase of the control signal to thereby adjust the phase of the blade pitch adjustment applied to the at least one control blade.

8. The vehicle of claim 7 wherein the control system is further configured to adjust the magnitude of the control signal to thereby adjust the magnitude of the blade pitch adjustment applied to the at least one control blade.

9. The vehicle of claim 1 further comprising a second impeller configured to rotate in an opposite direction from the impeller, wherein the second impeller comprises a second hub, a second plurality of fixed blades and at least one second control blade coupled to a second magnet and pivotable with respect to the second hub.

10. The vehicle of claim 10 further comprising a second magnetic actuator coupled to the second impeller wherein the magnetic field is operable to displace the second magnet and to thereby pivot the at least one second control blade with respect to the second hub.

11. The vehicle of claim 10 wherein the control system is further configured to provide a second control signal to the second magnetic actuator.

12. An impeller assembly configured to rotate on a driveshaft for a vehicle, the impeller comprising:

an impeller hub;

a plurality of fixed impeller blades rigidly coupled to the impeller hub, each of the fixed impeller blades having a common blade pitch; and

a control blade assembly pivotably coupled to the impeller hub, wherein the control blade assembly comprises:

a pair of control blades joined by a shaft;

a magnet assembly coupled to the shaft; and

a bearing assembly supporting the shaft within the impeller hub such that the shaft is configured to pivot in response to an electromagnetic field applied to the magnet assembly to thereby adjust the blade pitch of the control blades.

13. The impeller assembly of claim 12 wherein the magnet assembly comprises a first magnet coupled to the shaft by an arm.

14. The impeller assembly of claim 13 wherein the magnet assembly comprises a second magnet coupled to the first magnet by at least one journal bearing.

15. A method of controlling the heading of a vehicle with an impeller having a plurality of impeller blades, the method comprising the steps of:

rotating the impeller about a driveshaft to produce propulsive force;

generating a control signal for at least one of the plurality of impeller blades, wherein the control signal has an amplitude and a phase corresponding to a desired heading of the vehicle;

producing a magnetic field as a function of the control signal; and

pivoting at least one of the plurality of impeller blades in response to the magnetic field to produce a torque on the driveshaft having a magnitude and phase corresponding to the magnitude and phase of the control signal to thereby control the heading of the vehicle.

16. The method of claim 15 wherein the rotating step comprises selecting a forward or reverse direction for rotating the impeller.

17. The method of claim 15 wherein the control signal has a substantially sinusoidal waveform.

18. The method of claim 15 wherein the control signal has a substantially sawtooth waveform.

19. A variable pitch control blade assembly for an impeller having an impeller hub, the control blade assembly comprising:

a pair of control blades joined by a shaft;

a magnet assembly coupled to the shaft; and

a bearing assembly configured to pivotably support the shaft within the impeller hub such that the shaft is configured to pivot in response to an electromagnetic field applied to the magnet assembly to thereby adjust the blade pitch of the control blades.

20. A system for producing a desired heading in a vehicle, the system comprising:

an impeller means rotating on a driveshaft, the impeller means comprising a plurality of impeller blades;

means for rotating the impeller means about the driveshaft to produce propulsive force;

means for generating a control signal having an amplitude and a phase corresponding to the desired heading of the vehicle; and

means for producing a magnetic field as a function of the control signal; and

means for pivoting at least one of the plurality of impeller blades in response to the magnetic field to produce a torque on the driveshaft having a magnitude and phase corresponding to the magnitude and phase of the control signal to thereby place the vehicle in the desired heading.